

**U.S. DEPARTMENT OF ENERGY
DEPARTMENT-WIDE
FUNCTIONAL AREA QUALIFICATION STANDARD**

NUCLEAR SAFETY SYSTEMS QUALIFICATION STANDARD

Defense Nuclear Facilities Technical Personnel



**U.S. Department of Energy
Washington, D.C. 20585**

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Approval and Concurrence

The Assistant Secretary for Defense Programs is the Management Sponsor for the Department-wide Nuclear Safety Systems Functional Area Qualification Standard. The Management Sponsor is responsible for reviewing the Qualification Standard to ensure that the technical content is accurate and adequate for Department-wide application. The Management Sponsor, in coordination with the Human Resources organization, is also responsible for ensuring that the Qualification Standard is maintained current. Concurrence with this Qualification Standard by the Assistant Secretary for Defense Programs is indicated by the signature below.

The Technical Personnel Program Coordinator (TPPC) is responsible for coordinating the consistent development and implementation of the Technical Qualification Program throughout the Department of Energy. Concurrence with this Qualification Standard by the Technical Personnel Program Coordinator is indicated by the signature below.

The Technical Excellence Executive Committee (TEEC) consists of senior Department of Energy managers. This Committee is responsible for reviewing and approving the Qualification Standard for Department-wide application. Approval of this Qualification Standard by the Technical Excellence Executive Committee is indicated by the signature below.

NOTE: The signatures below reflect concurrence and approval of this Qualification Standard for interim Implementation. Final concurrence and approval will occur in December 1995, pending comments received based upon implementation.

CONCURRENCE:

Assistant Secretary for
Defense Programs

Technical Personnel Program
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APPROVAL:

Chairman
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FUNCTIONAL AREA

Nuclear Safety Systems

PURPOSE

The Technical Qualification Program is divided into three levels of technical competence and qualification. The General Technical Base Qualification Standard establishes the base technical competence required of all Department of Energy defense nuclear facility technical personnel. The Functional Area Qualification Standards build on the requirements of the General Technical Base Qualification Standard and establish Department-wide functional competence requirements in each of the identified functional areas. Office/facility-specific qualification standards establish unique operational competency requirements at the Headquarters or Field element, site, or facility level.

The Nuclear Safety System Functional Area Qualification Standard establishes common functional area competency requirements for all Department of Energy nuclear safety technical personnel who provide management oversight or direction impacting the safe operation of defense nuclear facilities. Satisfactory and documented completion of the competency requirements contained in this Standard ensures that technical employees possess the minimum requisite competence to fulfill their functional area duties and responsibilities. Additionally, these competency requirements provide the functional foundation to assure successful completion of the appropriate Office/facility-specific qualification standard.

APPLICABILITY

This Standard applies to all Department of Energy nuclear safety system technical personnel who provide management direction or oversight impacting the safe operation of defense nuclear facilities. Personnel designated by Headquarters or Field element line management as participants in the Technical Qualification Program are required to meet the requirements of this Standard as defined in DOE Order 3410, Training.

IMPLEMENTATION REQUIREMENTS

The competencies contained in the Standard are divided into the following four categories:

1. General Technical
2. Regulatory
3. Administrative
4. Management, Assessment, and Oversight

Each of the categories is defined by one or more competency statements indicated by bold print. The competency statements define the expected knowledge and/or skill that an individual must possess, and are requirements. Each of the competency statements is further explained by a

listing of supporting knowledge and/or skill statements. The supporting knowledge and/or skill statements are not requirements and do not necessarily have to be fulfilled to meet the intent of the competency.

The competencies identify a familiarity level, working level, or expert level of knowledge; or they require the individual to demonstrate the ability to perform a task or activity. These levels are defined as follows:

Familiarity level is defined as basic knowledge of or exposure to the subject or process adequate to discuss the subject or process with individuals of greater knowledge.

Working level is defined as the knowledge required to monitor and assess operations/activities, to apply standards of acceptable performance, and to reference appropriate materials and/or expert advice as required to ensure the safety of Departmental activities.

Expert level is defined as a comprehensive, intensive knowledge of the subject or process sufficient to provide advice in the absence of procedural guidance.

Demonstrate the ability is defined as the actual performance of a task or activity in accordance with policy, procedures, guidelines, and/or accepted industry or Department practices.

Headquarters and Field elements shall establish a program and process to ensure that all defense nuclear facility technical personnel required to participate in the Technical Qualification Program meet the competency requirements contained in this Standard. Documentation of the completion of the requirements of this Standard shall be included in the employee's training and qualification record.

In select cases, it may be necessary to exempt an individual from completing one or more of the competencies in this Functional Area Qualification Standard. Exemptions from individual competencies shall be justified and documented in accordance with DOE Order 3410, Training. Exemptions shall be requested by the individual's immediate supervisor, and approved one level above the individual's immediate supervisor.

Equivalencies may be granted for individual competencies based upon an objective evaluation of the employee's prior education, experience, and/or training. Documentation of equivalencies shall indicate how the competency requirements have been met. The supporting knowledge and/or skill statements may be considered when evaluating an individual's ability with respect to each competency requirement.

Training shall be provided to employees in the Technical Qualification Program who do not meet the competencies contained in the qualification standard. Departmental training will be based upon supporting knowledge and/or skill statements similar to the ones listed for each of the competency statements. Headquarters and Field elements should use the supporting knowledge and/or skill statements as a basis for evaluating the content of any training courses used to provide individuals with the requisite knowledge and/or skill required to meet the qualification standard competency statements.

DUTIES AND RESPONSIBILITIES

The following are duties and responsibilities normally expected of defense nuclear facility technical personnel assigned to the nuclear safety systems functional area:

- A. Maintain and increase professional knowledge and expertise related to the field of nuclear safety.
- B. Communicate nuclear safety issues to Department and contractor management and other stakeholders and assist in the resolution of these issues.
- C. Participate in the development, review, approval, and interpretation of nuclear safety Orders, policies, standards, and documents.
- D. Develop plans and schedules to support future nuclear safety-related activities.
- E. Participate in Departmental self-assessments in the area of nuclear safety.

The duties and responsibilities listed below are covered generically by this Department-wide Qualification Standard, and should be supplemented as applicable by Office/facility-specific Qualification Standards. Additional duties and responsibilities specific to the site, facility, operational activities, and/or other involved organizations shall also be contained in the Office/facility-specific Qualification Standard.

- Participate in the preparation, review, and/or recommendation for approval of nuclear safety documents (e.g., Safety Analysis Reports, Technical Safety Requirements, Unreviewed Safety Questions, Safety Evaluation Reports, etc.).
- Evaluate the nuclear safety of contractor nuclear facilities and operations for Price-Anderson Amendment Act compliance, contract performance, operational readiness reviews, readiness assessments, and other periodic assessments.
- Participate in nuclear accident/incident investigations.
- Participate in emergency response activities.
- Participate in enforcement of Price-Anderson Amendment Act requirements.

BACKGROUND AND EXPERIENCE

The U. S. Office of Personnel Management's Qualification Standards Handbook establishes minimum education, training, experience, or other relevant requirements applicable to a particular occupational series/grade level, as well as alternatives to meeting specified requirements.

The preferred education and experience for nuclear safety system personnel is:

1. Education:

Bachelor of Science degree in nuclear engineering or physics; or meet the alternative requirements specified in the Qualifications Standards Handbook.

2. Experience:

Industry and/or Department of Energy site/facility experience that has provided specialized knowledge in the areas of criticality safety, Safety Analysis Reports, Technical Safety Requirements, unreviewed safety questions, risk analysis and management, nuclear facility design and operations, and the packaging/transportation/storage of radioactive material.

REQUIRED COMPETENCIES

The competencies contained in this Standard are distinct from those competencies contained in the General Technical Base Qualification Standard. All nuclear safety system personnel must complete the competency requirements of the General Technical Base Qualification Standard prior to or in parallel with the completion of the competency requirements contained in this Standard. Each of the competency statements defines the level of expected knowledge and/or skill that an individual is required to possess to meet the intent of this Standard. The supporting knowledge and/or skill statements further describe the intent of the competency statements but are not requirements.

1. GENERAL TECHNICAL

1.1 Nuclear safety system personnel shall demonstrate a working level knowledge of the fission process.

Supporting Knowledge and/or Skills

- a. Define the following terms:
 - Excitation energy
 - Critical energy
 - Fissile material
 - Fissionable material
 - Fertile material
- b. Describe the curve of binding energy per nucleon vs. mass number and give a qualitative description of the reasons for its shape.
- c. Explain why only the heaviest nuclei are easily fissioned.
- d. Explain why uranium-235 fissions with thermal neutrons and uranium-238 fissions only with fast neutrons.
- e. Characterize the fission products in terms of mass groupings and radioactivity.

1.2 Nuclear safety system personnel shall demonstrate a working level knowledge of the various types of radiation interaction with matter.

Supporting Knowledge and/or Skills

- a. Describe the interactions of the following with matter:
 - Alpha particle
 - Beta particle
 - Positron
 - Neutron
- b. Describe the following ways that gamma radiation interacts with matter:
 - Compton scattering
 - Photoelectric effect
 - Pair production

1.3 Nuclear safety system personnel shall demonstrate a working level knowledge of criticality control and safety parameters.

Supporting Knowledge and/or Skills

- a. Discuss the effects and applications of the following factors relevant to criticality safety of operations:
 - Mass
 - Shape
 - Interaction
 - Separation
 - Geometry
 - Moderation
 - Reflection
 - Concentration
 - Volume
 - Density
 - Neutron absorbers
 - Heterogeneity
 - Enrichment
- b. Discuss the influence of the presence of non-fissionable materials mixed with, or in contact with, fissionable material on nuclear criticality safety.
- c. Discuss the concept of contingencies for checking the validity of criticality safety limits.

1.4 Nuclear safety system personnel shall demonstrate a working level knowledge of alarm systems for criticality accidents.

Supporting Knowledge and/or Skills

- a. Define the following terms:
 - Criticality accident
 - Minimum accident of concern
 - Process area
- b. Discuss the general principles associated with the use of criticality alarm systems including the following:
 - Installation
 - Coverage
 - Detection
 - Alarms
 - Dependability
- c. Discuss the requirements for testing the criticality alarm system.

1.5 Nuclear safety system personnel shall demonstrate a working level knowledge of neutron poisons.

Supporting Knowledge and/or Skills

- a. Describe the use of neutron poisons.
- b. Define the following terms:
 - Burnable poison
 - Nonburnable poison
 - Chemical shim
- c. Explain the purpose and use of Raschig Rings as a neutron poison.
- d. State an example of a material used as a fixed nonburnable neutron poison.

1.6 Nuclear safety system personnel shall demonstrate a working level knowledge of terminology used in nuclear safety analysis.

Supporting Knowledge and/or Skills

- a. Define the following accident related terms:
 - Accident
 - Authorization basis
 - Beyond design basis accident
 - Design basis
 - Design basis accidents
 - Evaluation guidelines
- b. Define the following hazard related terms:
 - Hazard
 - Hazard Classification
 - Hazard Category 1
 - Hazard Category 2
 - Hazard Category 3
 - Hazardous Material
- c. Define the following safety limit related terms:
 - Limiting conditions for operations
 - Limiting control settings
 - Risk
 - Safety analysis
 - Safety basis
 - Safety limits
- d. Differentiate between the following categories of individuals who may be affected by an accident at a Department nuclear facility:
 - Off-site individual
 - On-site individual
 - Public
 - Worker

- e. Differentiate between the function of structures, systems, and components in the following classifications:
 - Safety-class structures, systems, and components
 - Safety-significant structures, systems and components
- f. Differentiate between the function and contents of the following documents:
 - Safety Analysis Report (SAR)
 - Technical Safety Requirements (TSR)
- g. Differentiate between the plant/facility features which have the following designations:
 - Mitigating features
 - Preventive features
- h. Differentiate between the following types of facilities:
 - Nuclear facility
 - Non-reactor nuclear facility

1.7 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of nuclear accident analysis techniques.

Supporting Knowledge and/or Skills

- a. Identify and discuss essential elements of deterministic and probabilistic risk assessment techniques.
- b. Identify and discuss the methods used to determine and analyze failure modes.
- c. Discuss the methods used in the calculation of criticality safety, source term, environmental transport, and dose assessment activities including commonly used computer models.
- d. Discuss the methods used to identify and categorize the hazards associated with Department nuclear systems.

1.8 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of terminology associated with probabilistic risk assessment (PRA) techniques.

Supporting Knowledge and/or Skills

- a. Define the following terms with respect to probabilistic risk assessments:
 - Probability
 - Reliability
 - Availability
 - Unavailability

- Risk
 - Safety
 - Accident sequence
 - Dominant contributors
 - Minimal cut set
- b. Define the following terms and differentiate between the associated processes:
- Event tree
 - Fault tree

1.9 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of basic heating, ventilation, air conditioning system (HVAC) and filtration system construction, operation, and application.

Supporting Knowledge and/or Skills

- a. Given a one-line diagram of a heating, ventilation, air conditioning system, identify the following components and discuss their purposes:
- Blowers
 - Fans
 - Dampers
 - Chillers
 - Filters
 - Heat exchangers
 - Scrubbers
 - Hoods
 - Glove boxes
 - Pressure sensors
- b. Discuss the relationships between the following in heating, ventilation, and air conditioning systems:
- Supply ventilation
 - Flow
 - Exhaust ventilation
- c. Describe the purpose of the heating, ventilation, and air conditioning system in the following applications:
- Hoods
 - Glove boxes
 - Hot cells
 - Confinement systems
- d. Discuss the reason for and safety significance of the following system parameters:
- Positive vs. Negative system pressure
 - Differential pressure across filters
 - Differential pressure across components

- e. Discuss the potential hazards (to equipment and personnel) associated with the use of heating, ventilation, and air conditioning systems and components within nuclear safety-related systems.

1.10 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of process instrumentation principles of operation as applied to nuclear safety-related systems.

Supporting Knowledge and/or Skills

- a. Explain the process-related reason for measuring temperature, pressure, flow, and fluid level.
- b. For the temperature detection devices listed, explain how the instrument provides an output representative of the temperature being measured:
 - Thermocouple (TC)
 - Resistance temperature detector (RTD)
- c. For the pressure detection devices listed, explain how the instrument provides an output representative of the pressure being measured:
 - Bellows
 - Bourdon tube
 - Differential pressure
- d. For the fluid level detection devices listed, explain how the instrument provides an output representative of the level being measured:
 - Gauge-glass
 - Conductive probe
 - Magnetic bond
 - Differential pressure
 - Ball float
- e. For the flow detection devices listed, explain how the instrument provides an output representative of the flow being measured:
 - Orifice plate
 - Venturi tube
 - Pitot tube
 - Displacement
 - Dall Ball flow tube
 - Ultrasonic
 - Electromagnetic
- f. For the position detection devices listed, explain how the detector provides an output representative of the position being represented:
 - Synchronous
 - Limit switches
 - Reed switches

- Potentiometer
 - Linear variable differential transformer types
- g. Referring to a piping and instrumentation drawing (P&ID) containing temperature, pressure, level, flow, or position detection components, explain their function in the designated system and relationship to system safety.
- h. Discuss the importance of process instrumentation to nuclear safety.

1.11 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of piping and instrumentation drawings (P&ID).

Supporting Knowledge and/or Skills

- a. Given a piping and instrumentation drawing, identify/interpret the symbols used for system components including the following as a minimum:
- Valves
 - Pumps
 - Heat exchangers
 - Filters/Strainers
 - Fans
 - Compressors
 - Instruments
 - Indicators
 - Controllers
- b. Identify how valve conditions (open/closed) are depicted.
- c. Determine and follow system flowpath(s).

1.12 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of electrical diagrams and schematics.

Supporting Knowledge and/or Skills

- a. Given a system diagram, identify/interpret the following symbols:
- Motors
 - Controllers
 - Breakers
 - Generators
 - Batteries
- b. Given the appropriate diagram, state the condition (energized/de-energized) in which all electrical devices are shown, unless otherwise noted on the diagram.
- c. Given a system diagram, identify the power sources and/or loads and their status.

1.13 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of

electrical logic diagrams.

Supporting Knowledge and/or Skills

- a. Given a logic diagram, identify/interpret the symbols used on logic diagrams to represent the components.
- b. Identify the symbols used to denote a logical "1" (high/on) and a logical "0" (low/off) as used in logic diagrams.
- c. Given a logic diagram and appropriate information, determine the output of each component and the logic circuit.
- d. Given a logic diagram, identify three different trip settings and trace the resulting actions should the trip occur.

2. REGULATORY

NOTE: When Department of Energy directives are referenced in the qualification standard, the most recent revision should be used.

2.1 Nuclear safety system personnel shall demonstrate a working level knowledge of Department of Energy (DOE) Order 5000.3B, Occurrence Reporting and Processing of Operations Information, with respect to its impact on Department nuclear safety.

Supporting Knowledge and/or Skills

- a. State the purpose of DOE Order 5000.3B, Occurrence Reporting and Processing of Operations Information.
- b. Define the following terms:
 - Event
 - Condition
 - Facility
 - Notification Report
 - Occurrence Report
 - Reportable Occurrence
- c. Discuss the Department's policy regarding the reporting of occurrences as outlined in DOE Order 5000.3B, Occurrence Reporting and Processing of Operations Information.
- d. State the different categories of reportable occurrences and discuss each.
- e. Discuss the categorization, notification, and timeliness requirements associated with the following:
 - Notification Report
 - 10-Day Occurrence Report
 - Final Report
 - Closing out and verifying Occurrence Reports
 - Processing Occurrence Reports which cross the lines of professional responsibility of electrical systems personnel
 - Contractor Occurrence Reporting Procedures
- f. Discuss the general process for preparing and submitting occurrence reports and their follow-up.
- g. Using Attachment 1 to DOE Order 5000.3B, Occurrence Reporting and Processing of Operations Information, discuss the role of nuclear safety personnel in nuclear safety-related reportable occurrences.

- h. Given an occurrence report, determine the following:
 - The adequacy of the review process used
 - That causes were appropriately defined
 - That corrective actions addressed causes
 - That the lessons learned were appropriate
 - That corrective actions have been completed
- i. Using an occurrence report involving nuclear safety activities, identify and discuss the factors contributing to the occurrence.

2.2 Nuclear safety system personnel shall demonstrate a working level knowledge of Department of Energy (DOE) Order 5480.21, Unreviewed Safety Questions, with respect to its impact on Department nuclear safety.

Supporting Knowledge and/or Skills

- a. Discuss the reasons for performing an Unreviewed Safety Question determination.
- b. Define the following terms:
 - Accident analyses
 - Safety evaluation
 - Technical Safety Requirements
- c. Describe the situations for which a safety evaluation is required to be performed.
- d. Define the conditions for an Unreviewed Safety Question.
- e. Describe the responsibilities of contractors authorized to operate defense nuclear facilities for the performance of safety evaluations.
- f. Describe the actions to be taken by a contractor upon identifying information that indicates a potential inadequacy of previous safety analyses or, a possible reduction in the margin of safety as defined in the Technical Safety Requirements.
- g. Discuss the qualification and training requirements for personnel who perform safety evaluations.
- h. Discuss the actions to be taken if it is determined that an Unreviewed Safety Question is involved.
- i. Discuss the following terms as they apply to Unreviewed Safety Questions:
 - Categorical exclusions
 - Prior Unreviewed Safety Question safety evaluations
 - Inconsequential changes
 - Margin of Safety
 - Design Basis Accidents
 - Important to Safety
 - Authorization Basis

2.3 Nuclear safety system personnel shall demonstrate a working level knowledge of the Technical Safety Requirements as described in Department of Energy (DOE) Order 5480.22, Technical Safety Requirements, with respect to its impact on Department nuclear safety.

Supporting Knowledge and/or Skills

- a. Discuss the purpose of Technical Safety Requirements.
- b. Describe the responsibilities of contractors authorized to operate defense nuclear facilities for Technical Safety Requirements.
- c. Define the following terms and discuss the purpose of each:
 - Safety Limit
 - Limiting Control Settings
 - Limiting Conditions for Operation
 - Surveillance Requirements
- d. Describe the general content of each of the following sections of the Technical Safety Requirements:
 - Use and Application
 - Safety Limits
 - Operating Limits
 - Surveillance Requirements
 - Administrative Controls
 - Basis
 - Design Features
- e. Discuss the definition and implementation principles for the term OPERABILITY as used in a Technical Safety Requirement.
- f. Discuss the conditions that constitute a violation of the Technical Safety Requirements and state the reporting requirements should a violation occur.
- g. Discuss the requirements for administrative control of the Technical Safety Requirements.
- h. Discuss the possible source documents that may be used in developing Technical Safety Requirements.

- i. Differentiate between the following facility designations:
 - Category A reactor facility
 - Category B reactor facility
- j. Discuss the requirements for emergency actions that depart from the approved Technical Safety Requirements.

2.4 Nuclear safety system personnel shall demonstrate a working level knowledge of Department of Energy (DOE) Order 5480.23, Nuclear Safety Analysis Reports, with respect to its impact on Department nuclear safety.

Supporting Knowledge and/or Skills

- a. Discuss the four basic purposes and objectives of Nuclear Safety Analysis Reports.
- b. Describe the responsibilities of contractors authorized to operate defense nuclear facilities for the development and maintenance of a Nuclear Safety Analysis Report.
- c. Define the following terms and discuss the purpose of each:
 - Design Basis
 - Engineer Safety Features
 - Safety Analysis
- d. Describe the requirements for the scope and content of a Nuclear Safety Analysis Report and discuss the general content of each of the required sections of the Report.
- e. Discuss the approval requirements for the Nuclear Safety Analysis Report for new facilities and subsequent changes to the Report.
- f. Define who approves facility operations prior to achieving Safety Analysis Report upgrade approval.
- g. Discuss the provisions for temporary and permanent exemptions from the requirements of DOE Order 5480.23, Safety Analysis Reports.
- h. Discuss the requirements for the contractor to maintain the Safety Analysis Report current.

2.5 Nuclear safety system personnel shall demonstrate a working level knowledge of Department of Energy (DOE) Order 5480.24, Nuclear Criticality Safety, with respect to its impact on Department nuclear safety.

Supporting Knowledge and/or Skills

- a. Discuss the purpose and policy associated with DOE Order 5480.24, Nuclear Criticality Safety.
- b. Define the following terms associated with nuclear criticality safety:
 - Criticality incident
 - Double contingency principle
 - Geometry control
 - Nuclear criticality safety
 - Significant quantity of fissionable material
 - Temporary exemption
- c. Discuss the Management and Operating (M&O) Contractor responsibilities for to the following in relation to criticality safety activities:
 - Criticality safety evaluations
 - Monitoring
 - Surveillance
 - Transportation
 - Storage
- d. Discuss the role of Department nuclear safety personnel with respect to the implementation of the requirements of DOE Order 5480.24, Nuclear Criticality Safety.

2.6 Nuclear safety system personnel shall demonstrate a working level knowledge of the nuclear safety-related requirements contained in Department of Energy (DOE) Order 6430.1A, General Design Criteria.

Supporting Knowledge and/or Skills

- a. Discuss the purpose, scope, and applicability of DOE Order 6430.1A, General Design Criteria.
- b. Discuss the Department policy and objectives with respect to safety-class criteria.
- c. Discuss the Responsibilities and Authorities section of DOE Order 6430.1A, General Design Criteria, with respect to implementation.
- d. Discuss the content of the General Requirements section of Division 13 - Special Facilities of DOE Order 6430.1A, General Design Criteria.

2.7 Nuclear safety system personnel shall demonstrate a working level knowledge of Department of Energy (DOE) Order 5480.31, Start-up and Restart of Nuclear Facilities, with respect to nuclear safety issues.

Supporting Knowledge and/or Skills

- a. Discuss the purpose, scope, and applicability sections of DOE Order 5480.31, Start-up and Restart of Nuclear Facilities.

- b. Discuss the content of the requirements section of DOE Order 5480.31, Start-up and Restart of Nuclear Facilities.
- c. Discuss the Responsibilities and Authorities section of DOE Order 5480.31, Start-up and Restart of Nuclear Facilities, with respect to implementation.
- d. Define the following terms as they relate to DOE Order 5480.31, Start-up and Restart of Nuclear Facilities, and nuclear safety:
 - Facility shutdown
 - Operational readiness review
 - Operational readiness review breadth
 - Operational readiness review depth
 - Operational readiness review implementation plan
 - Operational readiness review scope
 - Plan-of-action
 - Prestart finding
 - Readiness assessment
 - Unplanned shutdown
- e. Discuss Management and Operating Contractor responsibilities for implementing DOE Order 5480.31, Start-up and Restart of Nuclear Facilities.
- f. Discuss the role of Department nuclear safety personnel in implementing the requirements of DOE Order 5480.31, Start-up and Restart of Nuclear Facilities.

2.8 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of Department of Energy (DOE) Order 5482.1B, Environment, Safety, and Health Appraisal Program.

Supporting Knowledge and/or Skills

- a. Discuss the following nuclear safety assessments/surveillance activities:
 - Determination of assessment/surveillance requirements
 - Operation/Area Office and contractor notification
 - Assessment/surveillance agenda
- b. Identify and discuss the essential elements of the following:
 - Team pre-assessment meetings
 - Assessment entrance meetings
 - Assessment activities

- Assessment exit meetings
 - Team post-assessment meetings
- c. Discuss the steps involved in the preparation of an assessment report.

2.9 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of the following criticality safety-related American National Standards Institute/American Nuclear Society (ANSI/ANS) standards:

- **ANSI/ANS-8.1, Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors.**
- **ANS-8.3 (ANSI N-16.2), Criticality Accident Alarm System**
- **ANS-8.5 (ANSI N-16.4), Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material**
- **ANSI/ANS-8.7, Guide for Nuclear Criticality Safety in the Storage of Fissile Materials.**
- **ANS-8.15, Nuclear Criticality Control of Special Actinide Elements**
- **ANS-8-19, Administrative Practices for Nuclear Criticality Safety**

Supporting Knowledge and/or Skills

- a. Describe the contents, requirements, and relationship among the above American National Standards Institute/American Nuclear Society Standards.
- b. Discuss the applicability of the above American National Standards Institute/American Nuclear Society Standards to the Department facilities and processes.
- c. Discuss the role of the Department nuclear safety personnel in implementing the requirements of these Standards.

2.10 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of the following Department of Energy (DOE) Orders, Technical Standards, and Notice:

- **DOE Order 2300.1B, Audit Resolution and Follow-up**
- **DOE Order 2321.1B, Auditing of Programs and Operations**
- **DOE Order 5400.5, Radiation Protection of the Public and Environment**
- **DOE Order 5480.1B, Environment, Safety and Health Program for DOE Operations**
- **DOE Order 5480.11, Radiation Protection for Occupational Workers**

- **DOE Order 5660.1, Management of Nuclear Materials**
- **DOE-STD-3006-93, Planning and Conduct of Operational Readiness Reviews**
- **DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports**
- **DOE-STD-3011-94, Guidance for Preparation of DOE Order 5480.22 (TSR) and DOE Order 5480.23 (SAR) Implementation Plans**
- **Secretary of Energy Notice (SEN) SEN-35-91, Nuclear Safety Policy**

Supporting Knowledge and/or Skills

- a. Describe the contents, requirements, and relationship between the above Orders, Technical Standards, and Secretary of Energy Notice.
- b. Describe the role of nuclear safety personnel with respect to the requirements in these Orders, Standards, and Secretary of Energy Notice.

2.11 Nuclear safety system personnel shall demonstrate a working level knowledge of the Price-Anderson Amendment Act of 1988 and its impact on Department of Energy nuclear safety activities.

Supporting Knowledge and/or Skills

- a. Describe the purpose and scope of the Price-Anderson Amendment Act.
- b. Discuss the Act's applicability to the Department nuclear safety activities.
- c. Discuss the civil and criminal penalties imposed on the Department, Management and Operating Contractors, and Subcontractors as the result of a violation of applicable rules and regulations related to nuclear safety.
- d. Discuss the requirements associated with the topics below, as they are affected by Rule-making aspect of the Price-Anderson Amendment Act:
 - Safety Analysis Reports
 - Unreviewed Safety Questions
 - Quality Assurance Requirements
 - Defect Identification and Reporting
 - Conduct of Operations at DOE Nuclear Facilities
 - Technical Safety Requirements
 - Training and Certification
 - Maintenance Management
 - Categorization, Notification, Reporting, and Processing of Operational Occurrences at DOE Nuclear Facilities
- e. Discuss the role of Department nuclear safety personnel with respect to implementing the requirements of the Price-Anderson Amendment Act.

2.12 Nuclear safety system personnel shall demonstrate a working level knowledge of the requirements in Department of Energy (DOE) Technical Standard DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports.

Supporting Knowledge and/or Skills

- a. Discuss the conceptual basis and process for preparation of a facility/process safety analysis report (SAR).
- b. Discuss the following in relation to the preparation of the safety analysis report:
 - Worker safety
 - Defense-in-depth
 - Programmatic Commitments
 - Technical safety requirements (TSRs)
 - Structures, systems, and components (SSCs)
 - Hazard analysis
 - Accident analysis
 - Application of the graded approach.
- c. Discuss the relationship between DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports, and DOE Order 5480.23, Nuclear Safety Analysis Reports.
- d. Compare the requirements for the safety analysis report chapter structure and content as specified in each of the following:
 - DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports
 - DOE Order 5480.23, Nuclear Safety Analysis Reports.

3. ADMINISTRATIVE

NOTE: When Department of Energy directives are referenced in the qualification standard, the most recent revision should be used.

3.1 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of communications (both oral and written) when working or interacting with the contractor, stakeholders, and other internal and external organizations.

Supporting Knowledge and/or Skills

- a. Describe the roles and responsibilities of nuclear safety personnel for the following:
 - DOE Order 5500.4A, Public Affairs Policy and Planning Requirements for Emergencies
 - DOE Order 1700.1, Freedom of Information Program
- b. Identify the various internal and external groups with whom nuclear safety personnel must interface in the performance of their duties.
- c. Describe the media that may be utilized to communicate with these groups.

3.2 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of the general principles associated with the development, negotiation, and management of agreements, including memorandums of agreement (MOAs), memorandums of understanding (MOUs), and agreements in principle (AIPs).

Supporting Knowledge and/or Skills

- a. Define and compare the following types of agreements:
 - Agreement in principle
 - Memorandum of agreement
 - Memorandum of understanding
- b. Discuss the role of nuclear safety personnel in the development, negotiation, and approval of agreements in principle.
- c. Given a memorandum of agreement/memorandum of understanding/ agreement in principle related to nuclear safety issues, review the document and discuss its adequacy in meeting the Department's needs.

3.3 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of nuclear safety-related data and information management requirements in accordance with the requirements of the following Department of Energy (DOE) Orders:

- DOE Order 1324.2B, Records Disposition

- **DOE Order 5700.6C, Quality Assurance**
- **DOE Order 1430.1D, Scientific and Technical Information Management**

Supporting Knowledge and/or Skills

- a. Describe the Authorized Disposition Requirements for nuclear safety-related records in DOE Order 1324.2B, Records Disposition.
- b. Describe the requirements for documents and records in DOE Order 5700.6C, Quality Assurance; Criterion Four, Documents and Records.
- a. Describe the purpose, scope, contents, and requirements in these Orders.
- b. Discuss the applicability of the above Orders to the Department nuclear safety activities and processes.
- c. Discuss the role of the Department nuclear safety personnel in implementing the requirements of these Orders.

3.4 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of the following Department of Energy (DOE) safeguards, security, and nuclear material accountability Orders for nuclear safety-related issues:

- **DOE Order 5610.13, Joint Department of Energy/Department of Defense Nuclear Weapons System Safety, Security, and Control Activities**
- **DOE Order 5630.11A, Safeguards and Security**
- **DOE Order 5630.12A, Safeguards and Security Inspection and Assessment Program**
- **DOE Order 5632.1C, Protection and Control of Safeguards and Security Interests**
- **DOE Order 5632.2B, Control and Accountability of Nuclear Materials**
- **DOE Order 5634.1B, Facility Approvals, Security Surveys, and Nuclear Materials Surveys**
- **DOE Order 5635.4, Protection of Unclassified Controlled Nuclear Information**
- **DOE Order 5660.1B, Management of Nuclear Materials**

Supporting Knowledge and/or Skills

- a. Describe the purpose, scope, contents, and requirements of these Orders.
- b. Discuss the applicability of the above Orders to the Department nuclear safety activities and processes.
- c. Discuss the role of the Department nuclear safety personnel in implementing the requirements of these Orders.

4. MANAGEMENT, ASSESSMENT, AND OVERSIGHT

NOTE: When Department of Energy directives are referenced in the qualification standard, the most recent revision should be used.

4.1 Nuclear safety systems personnel shall demonstrate a working level knowledge of assessment techniques (such as the planning and use of observations, interviews, and document reviews) to assess facility performance, report results of assessments, and follow up on actions taken as the result of assessments.

Supporting Knowledge and/or Skills

- a. Describe the role of nuclear safety systems personnel in the assessment of Government Owned Contractor Operated (GOCO) facilities.
- b. Describe the assessment requirements and limitations associated with the interface with contractor employees.
- c. Discuss the essential elements of a performance-based assessment including:
 - Investigation
 - Fact finding
 - Exit interview
 - Reporting
 - Follow-up
 - Closure
- d. Describe the following assessment methods and the advantages or limitations of each method:
 - Document review
 - Observation
 - Interview
- e. Describe the action to be taken if the contractor challenges the assessment findings and explain how such challenges can be avoided.

4.2 Nuclear safety system personnel shall demonstrate a familiarity level knowledge of Department of Energy (DOE) financial management practices and the application of contractor resources to meet commitments to nuclear safety, quality, cost, and schedule.

Supporting Knowledge and Skills

- a. Describe the process for preparing cost estimates and budgets.
- b. Describe and contrast direct and indirect costs. List ways to reduce indirect costs.
- c. Define and explain the relationship between the following terms:

- Budgeted cost of work scheduled (BCWS)
 - Budgeted cost of work performed (BCWP)
 - Actual cost of work performed (ACWP)
 - Earned value (EV)
- d. Describe the types of Earned Value, and how they are measured.
 - e. Describe the types of data required to forecast cost and schedule performance.
 - f. Define the term "estimate at completion" (EAC).
 - g. Discuss the importance of formal change control in relation to project management.
 - h. Using existing program data, explain what planning and scheduling was performed to ensure that program requirements are achievable.
 - i. Using data from two nuclear safety-related programs, discuss each program's budget and its impact on program compliance.

4.3 Nuclear safety system personnel shall demonstrate a working level knowledge of program/project management practices and the application of contractor resources to meet commitments to nuclear safety, quality, cost, and schedule in accordance with the following Department of Energy (DOE) Orders:

- **DOE Order 4700.1, Project Management System**
- **DOE Order 4700.4, Project Manager Certification**

Supporting Knowledge and/or Skills

- a. Explain the purpose of project management within the Department, and describe the life cycle of a typical project.
- b. Describe the primary roles and responsibilities of nuclear safety personnel as outlined in DOE Order 4700.1, Project Management System, and DOE Order 4700.4, Project Manager Certification.
- c. Describe typical documents and data sources utilized in project management.
- d. Identify and explain the major elements of a project, and discuss their relationship.
- e. Explain the purpose and use of a project management plan (PMP).

- f. Discuss the role of configuration management as it relates to project management.
- g. Discuss the role of quality assurance as it relates to project management.
- h. Explain the use of safety plans in the management of projects.
- i. Discuss the relationship between work breakdown structure (WBS) and cost and schedule.
- j. Describe the purpose and use of work packages and/or planning packages.
- k. Describe the purpose of schedules, and discuss the use of milestones and activities.
- l. Describe the critical path method of scheduling.
- m. Explain the concept of a project management baseline and describe the four baselines used in project management.

4.4 Nuclear safety system personnel shall demonstrate a working level knowledge of the Department of Energy (DOE)/facility contract provisions necessary to provide oversight of a contractor's operations.

Supporting Knowledge and/or Skills

- a. Describe the role of nuclear safety personnel in contractor oversight.
- b. Compare and contrast the following:
 - Department of Energy's expectations of a Management and Operating (M&O) contractor
 - A Management and Operating contractor's expectations of the Department of Energy
- c. Identify the key elements and features of an effective Department of Energy and Management and Operating contractor relationship.
- d. Describe the responsibility nuclear safety personnel have associated with contractor compliance under the Price-Anderson Amendments Act.
- e. Describe the role of nuclear safety personnel in the cost-plus-award fee process.
- f. Explain the responsibilities of nuclear safety personnel for DOE Order 5480.29, Employee Concerns, and the identification, reporting, reviewing, and documentation of employee concerns.

4.5 Nuclear safety system personnel shall demonstrate a working level knowledge of problem analysis principles and the techniques necessary to identify Department

problems, potential causes, and corrective action(s) associated with nuclear safety issues.

Supporting Knowledge and/or Skills

- a. Describe and explain the application of problem analysis techniques including the following:
 - Root cause analysis
 - Causal factor analysis
 - Change analysis
 - Barrier analysis
 - Management oversight risk tree analysis
- b. Describe the following types of investigations and discuss an example of the application of each:
 - Type A
 - Type B
 - Type C
- c. Compare and contrast immediate, short term, and long term actions taken as the result of a problem identification or an occurrence.
- d. Given event and/or occurrence data, apply problem analysis techniques and identify the problems and how they might have been avoided.
- e. Describe various data gathering techniques and the use of trending/history when analyzing problems.

EVALUATION REQUIREMENTS

The following requirements shall be met to complete the Department-wide Nuclear Safety System Functional Area Qualification Standard. The evaluation process identified below serves as a measurement tool for assessing whether the participants have acquired the technical competencies outlined in this Standard.

1. Documented completion of the Department-wide General Technical Base Qualification Standard in accordance with the requirements contained in that Standard.
2. Documented completion of the competency requirements listed in this Functional Area Qualification Standard. Documentation of the successful completion of these competency requirements may be satisfied by a qualifying official using any of the following methods:
 - Documented evaluation of equivalencies
 - Written examination
 - Document oral evaluation
 - Documented observation of performance.

CONTINUING TRAINING AND PROFICIENCY REQUIREMENTS

Nuclear safety system personnel shall participate in an Office/facility/position-specific continuing training and qualification program that includes the following elements:

1. Technical education and/or training covering topics directly related to the duties and responsibilities of nuclear safety system personnel as determined by line management. This may include courses and/or training provided by:
 - Department of Energy
 - Other Government agencies
 - Outside vendors
 - Educational institutions.
2. Training covering topics that address identified deficiencies in the knowledge and/or skills of nuclear safety system personnel.
3. Training in areas added to the Nuclear Safety System Functional Area Qualification Standard since initial qualification.
4. Specific continuing training requirements shall be documented in Individual Development Plans (IDPs).